

WHAT IS CLAIMED IS:

- 1 1. A cathode composition for a lithium-ion battery having the formula
2 $\text{Li}[\text{M}^1_{(1-x)}\text{Mn}_x]\text{O}_2$ where $0 < x < 1$ and M^1 represents one or more metal elements, with the
3 proviso that M^1 is a metal element other than chromium,
4 said composition characterized as being in the form of a single phase having an O₃
5 crystal structure that does not undergo a phase transformation to a spinel crystal structure
6 when incorporated in a lithium-ion battery and cycled for 100 full charge-discharge cycles at
7 30°C and a final capacity of 130 mAh/g using a discharge current of 30 mA/g.
- 1 2. A cathode composition according to claim 1 wherein M^1 is selected from the
2 group consisting of Ni, Co, Fe, Cu, Li, Zn, V, and combinations thereof.
- 1 3. A cathode composition according to claim 1 wherein $x = (2-y)/3$ and $\text{M}^1_{(1-x)}$
2 has the formula $\text{Li}_{(1-2y)/3}\text{M}^2_y$, where $0 < y < 0.5$ and M^2 represents one or more metal elements,
3 with the proviso that M^2 is a metal element other than chromium,
4 said cathode composition having the formula $\text{Li}[\text{Li}_{(1-2y)/3}\text{M}^2_y\text{Mn}_{(2-y)/3}]\text{O}_2$.
- 1 4. A cathode composition according to claim 3 wherein $0.083 < y < 0.5$.
- 1 5. A cathode composition according to claim 3 wherein $0.167 < y < 0.5$.
- 1 6. A cathode composition according to claim 3 wherein M^2 is a single metal
2 element.
- 1 7. A cathode composition according to claim 6 wherein M^2 is Ni.
- 1 8. A cathode composition according to claim 1 wherein $x = (2-2y)/3$ and $\text{M}^1_{(1-x)}$
2 has the formula $\text{Li}_{(1-y)/3}\text{M}^3_y$, where $0 < y < 0.5$ and M^3 represents one or more metal elements,
3 with the proviso that M^3 is a metal element other than chromium,
4 said cathode composition having the formula $\text{Li}[\text{Li}_{(1-y)/3}\text{M}^3_y\text{Mn}_{(2-2y)/3}]\text{O}_2$.

1 9. A cathode composition according to claim 8 wherein $0.083 < y < 0.5$.

1 10. A cathode composition according to claim 8 wherein $0.167 < y < 0.5$.

1 11. A cathode composition according to claim 8 wherein M^3 is a single metal
2 element.

1 12. A cathode composition according to claim 11 wherein M^3 is Co.

1 13. A cathode composition according to claim 1 wherein $x = y$ and $M^1_{(1-x)}$ has the
2 formula $M^4_yM^5_{1-2y}$, where $0 < y < 0.5$, M^4 is a metal element other than chromium, and M^5 is a
3 metal element other than chromium that is different from M^4 ,

4 said cathode composition having the formula $Li[M^4_yM^5_{1-2y}Mn_y]O_2$.

1 14. A cathode composition according to claim 13 wherein $0.083 < y < 0.5$.

1 15. A cathode composition according to claim 13 wherein $0.167 < y < 0.5$.

1 16. A cathode composition according to claim 13 wherein M^4 is Ni.

1 17. A cathode composition according to claim 13 wherein M^5 is Co.

1 18. A cathode composition according to claim 13 wherein M^4 is Ni and M^5 is Co.

1 19. A lithium-ion battery comprising:

2 (a) an anode;

3 (b) a cathode; and

4 (c) an electrolyte separating said anode and said cathode,

5 said cathode comprising a composition having the formula $Li[M^1_{(1-x)}Mn_x]O_2$ where

6 $0 < x < 1$ and M^1 represents one or more metal elements, with the proviso that M^1 is a metal
7 element other than chromium,

8 said composition characterized as being in the form of a single phase having an O₃
9 crystal structure that does not undergo a phase transformation to a spinel crystal structure
10 when said lithium-ion battery is cycled for 100 full charge-discharge cycles at 30°C and a
11 final capacity of 130 mAh/g using a discharge current of 30 mA/g.

1